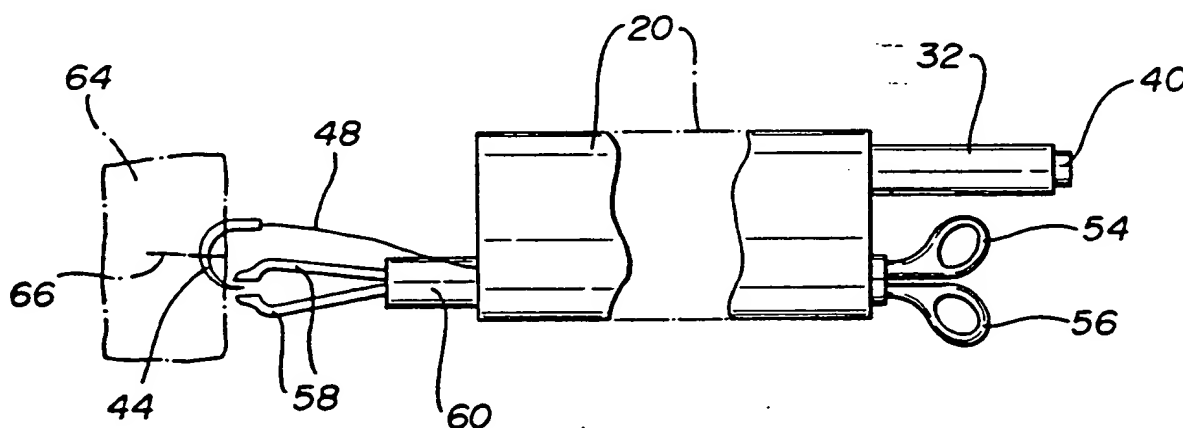


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : A61B 17/00		A1	(11) International Publication Number: WO 91/17712 (43) International Publication Date: 28 November 1991 (28.11.91)
(21) International Application Number: PCT/US91/03201 (22) International Filing Date: 8 May 1991 (08.05.91) (30) Priority data: 525,253 17 May 1990 (17.05.90) US (60) Parent Application or Grant (63) Related by Continuation US 525,253 (CIP) Filed on 17 May 1990 (17.05.90) (71)(72) Applicants and Inventors: WILK, Peter, J. [US/US]; 185 West End Avenue, New York, NY 10023 (US). SEKONS, David, H. [US/US]; 455 East 86th Street, New York, NY 10028 (US).		(74) Agent: SUDOL, R., Neil; Coleman & Sudol, 71 Broadway, Suite 1201, New York, NY 10006 (US). (81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US. Published With international search report.	

(54) Title: ENDOSCOPIC SUTURING DEVICE AND RELATED METHOD AND SUTURE



(57) Abstract

An endoscopic or laparoscopic suturing device comprises an endoscope (30) and a needle (44) having a spring bias construction tending to bend the needle into an arcuate configuration. The endoscope includes an elongate outer tubular member (20) and a biopsy channel (22) extending longitudinally through the tubular member. An inner tubular member (32) is disposed inside the biopsy channel of the outer tubular member, while the needle is disposed in a straightened configuration at least partially inside the inner tubular member at a distal end thereof. The surgical instrument further comprises an ejector device in the form of an elongate rod member (40) slidably disposed inside the inner tubular member proximally of the needle for ejecting the needle from the inner tubular member. A suture (46) is provided with an end attached to a proximal end of the needle (44), while a closure device in the form of a forceps (52) is provided for closing the suture upon an ejection of the needle from the biopsy channel by a distally directed motion of the rod member and a subsequent assumption by the needle of the arcuate configuration.

CLAIMS:

1. A surgical instrument comprising:
an endoscope or laparoscope including an elongate outer tubular member and a biopsy channel extending longitudinally through said tubular member;
an elongate rod member slidably disposed inside said biopsy channel;
a needle having a spring bias construction tending to bend said needle into an arcuate configuration, said needle being disposed in a straightened configuration at least partially inside said biopsy channel distally of a distal end of said rod member;
a suture having an end attached to a proximal end of said needle; and
means for closing said suture upon an ejection of said needle from said biopsy channel by a distally directed motion of said rod member and a subsequent assumption by said needle of said arcuate configuration.
2. The surgical instrument set forth in claim 1, further comprising an elongate inner tubular member slidably disposed in said biopsy channel, said rod member being slidably disposed inside said inner tubular member, said needle being disposed in a straightened configuration at least partially inside said inner tubular member distally of a distal end of said rod member.
3. The surgical instrument set forth in claim 2 wherein said biopsy channel includes a pair of parallel elongate main channel portions communicating with one another along their lengths via an elongate connecting channel portion.
4. The surgical instrument set forth in claim 3 wherein said inner tubular member is slidably disposed in one of said main channel portions.
5. The surgical instrument set forth in claim 4 wherein said means for closing includes an elongate forceps

member slidably disposed in the other of said main channel portions.

6. The surgical instrument set forth in claim 5 wherein said suture includes a loop member traversed by said elongate forceps member, said suture further including a thread member attached at one end to said needle and at an opposite end to said loop member, said thread member traversing said connecting channel portion.

7. The surgical instrument set forth in claim 6, further comprising means for locking said suture upon closure thereof by said means for closing.

8. The surgical instrument set forth in claim 6 wherein said means for locking includes a series of projections provided along said thread member and an aperture in said suture communicating with an opening defined by said loop member, said thread member having an outer diameter defined by said projections, said opening having a linear dimension substantially larger than said outer diameter, said aperture having a linear dimension smaller than said outer diameter, said means for locking further including means on said suture for preventing a removal of said thread member from said aperture upon a passing of said thread member through said loop member and a subsequent pulling of said thread member into said aperture from said loop member.

9. The surgical instrument set forth in claim 5 wherein said rod member, said inner tubular member, said forceps member, and said main channel portions are all substantially cylindrical.

10. The surgical instrument set forth in claim 2, further comprising arrest means for preventing said rod member from moving more than a predetermined distance in a distal direction relative to said inner tubular member.

11. The surgical instrument set forth in claim 10

wherein said arrest means includes a shoulder on said rod member engageable with a shoulder internal to said inner tubular member.

12. The surgical instrument set forth in claim 1, further comprising means for severing a portion of said suture upon a closing thereof.

13. The surgical instrument set forth in claim 12 wherein said means for severing includes a laser device with an optical fiber insertable through a longitudinal opening in said outer tubular member.

14. A surgical suturing assembly comprising:
an elongate tubular member having a diameter sufficiently small so that said tubular member is slidably insertable into a biopsy channel extending longitudinally through a tubular endoscopic member;
an elongate rod member slidably disposed inside said elongate tubular member;
a needle having a spring bias construction tending to bend said needle into an arcuate configuration, said needle being disposed in a straightened configuration at least partially inside said tubular member distally of a distal end of said rod member; and
a suture having an end attached to a proximal end of said needle.

15. The assembly set forth in claim 14, further comprising means for closing said suture upon an ejection of said needle from said tubular member by a distally directed motion of said rod member and a subsequent assumption by said needle of said arcuate configuration.

16. The assembly set forth in claim 15 wherein said means for closing includes an elongate forceps member.

17. The assembly set forth in claim 16 wherein said suture includes a loop member traversed by said elongate for-

ceps member, said suture further including a thread member attached at one end to said needle and at an opposite end to said loop member.

18. The assembly set forth in claim 17, further comprising means for locking said suture upon closure thereof by said means for closing.

19. The assembly set forth in claim 18 wherein said means for locking includes a series of projections provided along said thread member and an aperture in said suture communicating with an opening defined by said loop member, said thread member having an outer diameter defined by said projections, said opening having a linear dimension substantially larger than said outer diameter, said aperture having a linear dimension smaller than said outer diameter, said means for locking further including means on said suture for preventing a removal of said thread member from said aperture upon a passing of said thread member through said loop member and a subsequent pulling of said thread member into said aperture from said loop member.

20. The assembly set forth in claim 14 wherein said rod member and said tubular member are cylindrical.

21. The assembly set forth in claim 14, further comprising arrest means for preventing said rod member from moving more than a predetermined distance in a distal direction relative to said tubular member.

22. The assembly set forth in claim 21 wherein said arrest means includes a shoulder on said rod member engageable with a shoulder internal to said tubular member.

23. A surgical instrument comprising:
an endoscope or laparoscope including an elongate outer tubular member and a biopsy channel extending longitudinally through said tubular member;
a needle having a spring bias construction tending

to bend said needle into an arcuate configuration, said needle being disposed in a straightened configuration at least partially inside said biopsy channel at a distal end thereof;

means for ejecting said needle from said biopsy channel;

a suture having an end attached to a proximal end of said needle; and

means for closing said suture upon an ejection of said needle from said biopsy channel by said means for ejecting and a subsequent assumption by said needle of said arcuate configuration.

24. The surgical instrument set forth in claim 23 wherein said means for ejecting includes an elongate rod member slidably disposed inside said biopsy channel.

25. The surgical instrument set forth in claim 24 wherein said means for ejecting further includes an elongate inner tubular member slidably disposed in said biopsy channel, said rod member being slidably disposed inside said inner tubular member, said needle being disposed in a straightened configuration at least partially inside said inner tubular member distally of a distal end of said rod member.

26. The surgical instrument set forth in claim 23 wherein said means for closing includes an elongate forceps member slidably disposed in said endoscope or laparoscope.

27. The surgical instrument set forth in claim 26 wherein said suture includes a loop member traversed by said elongate forceps member, said suture further including a thread member attached at one end to said needle and at an opposite end to said loop member.

28. The surgical instrument set forth in claim 27, further comprising means for locking said suture upon closure thereof by said means for closing.

29. The surgical instrument set forth in claim 28

wherein said means for locking includes a series of projections provided along said thread member and an aperture in said suture communicating with an opening defined by said loop member, said thread member having an outer diameter defined by said projections, said opening having a linear dimension substantially larger than said outer diameter, said aperture having a linear dimension smaller than said outer diameter, said means for locking further including means on said suture for preventing a removal of said thread member from said aperture upon a passing of said thread member through said loop member and a subsequent pulling of said thread member into said aperture from said loop member.

30. The surgical instrument set forth in claim 23, further comprising means for severing a portion of said suture upon a closing thereof.

31. The surgical instrument set forth in claim 23 wherein said needle is provided with guide means for controlling orientation of said needle prior to and during ejection of said needle from said biopsy channel by said means for ejecting.

32. The surgical instrument set forth in claim 31 wherein said guide means includes an irregular cross-section of said needle.

33. The surgical instrument set forth in claim 32 wherein said needle has said irregular cross-section throughout only a portion of the length of said needle.

34. A suture device comprising:
a thread member provided along at least a portion of its length with a series of resilient projections, said thread member having an outer diameter defined by said projections;
a loop member defining an opening having a linear dimension substantially larger than said outer diameter; and
joining means for connecting one end of said thread member to said loop member, at least one of said joining means

and said loop member defining at least in part an aperture having a linear dimension smaller than said outer diameter, said aperture communicating with said opening defined by said loop;

locking means, provided on at least one of said joining means and said loop member, for preventing a removal of said thread member from said aperture upon a passing of said thread member through said loop member and a subsequent pulling of said thread member into said aperture from said loop member; and

a needle having a spring bias construction tending to bend said needle into an arcuate configuration, said needle having a sharp end and being attached at an opposite end to a free end of said thread member.

35. The suture device set forth in claim 34 wherein said aperture is formed on said loop member at a point therealong spaced from said joining means.

36. The suture device set forth in claim 34 wherein said locking means includes at least one protuberance on said loop.

37. The suture device set forth in claim 36 wherein said protuberance projects towards said aperture.

38. The suture device set forth in claim 37 wherein said protuberance is undercut on a side facing said aperture.

39. The suture device set forth in claim 34 wherein said joining means comprises a Y-shaped connector piece between said one end of said thread member and said loop member.

40. The suture device set forth in claim 34 wherein said projections are tapered from a larger transverse dimension down towards an end of said thread member opposite said joining means.

41. The suture device set forth in claim 34 wherein said projections are substantially hollow.

42. A suture device comprising:

a thread member provided along at least a portion of its length with a series of resiliently collapsible projections, said thread member having an outer diameter defined by said projections;

a loop member defining an opening having a linear dimension substantially larger than said outer diameter;

joining means for connecting one end of said thread member to said loop member, at least one of said joining means and said loop member defining at least in part an aperture having a linear dimension smaller than said outer diameter, said aperture communicating with said opening defined by said loop;

locking means, provided on at least one of said joining means and said loop member, for preventing a removal of said thread member from said aperture upon a passing of said thread member through said loop member and a subsequent pulling of said thread member into said aperture from said loop member; and

a needle having a spring bias construction tending to bend said needle into an arcuate configuration, said needle having a sharp end and being attached at an opposite end to a free end of said thread member.

43. The suture device set forth in claim 42 wherein said projections are collapsible under force applied along said thread member in one direction and expandable under force applied along said thread member in an opposite direction.

44. The suture device set forth in claim 43 wherein said projections are substantially hollow conical elements.

45. A surgical needle having a spring bias construction tending to bend said needle into an arcuate configuration, said needle being bendable into a straightened configuration, said needle having a sharp tip at one end, said

needle being provided at an opposite end with means for attaching said needle to a suture.

46. A method for performing a surgical operation on internal body tissues of a patient, comprising the steps of:

inserting a tubular endoscopic member through an aperture in the patient's body;

using said endoscopic member to visually locate the internal body tissues inside the patient's body;

upon locating said surgical site, pushing an elongate rod member in a distal direction through a biopsy channel in said tubular endoscopic member to eject a needle disposed in a straightened configuration inside said channel at a distal end of said tubular endoscopic member, said needle having a spring bias construction tending to bend said needle into an arcuate configuration, said needle having a proximal end attached to a suture;

upon ejection of said needle from said channel, passing said needle in said arcuate configuration through the internal body tissues;

upon passing of said needle through the internal body tissues, closing said suture; and

upon closure of said suture, withdrawing said tubular endoscopic member out of the patient's body through said aperture.

47. The method set forth in claim 46 wherein said needle has a sharp end opposite said proximal end and wherein said suture has a thread member and a loop member attached to said thread member at an end thereof opposite said needle, said step of closing comprising the steps of grasping said sharp end and pulling said needle and a portion of said thread member through said loop member.

48. The method set forth in claim 47 wherein said step of grasping includes the step of operating a forceps device.

49. The method set forth in claim 48 wherein said

step of pulling comprises the step of pulling a portion of said forceps device through said loop member.

50. The method set forth in claim 46, further comprising the step of locking said suture in a closed configuration upon closure of said suture.

51. The method defined in claim 46 wherein said aperture is a natural body opening.

52. The method defined in claim 46, further comprising the step of piercing the patient's body to form said aperture.

53. The method defined in claim 52 wherein said step of piercing is performed by using a trocar.

54. A surgical instrument comprising:
an endoscope or laparoscope including an elongate outer tubular member and a first biopsy channel and a second biopsy channel both extending longitudinally through said tubular member, said outer tubular member being formed with an elongate connecting channel connecting said first biopsy channel to said second biopsy channel along their lengths;

a suture device comprising:

a thread member provided along at least a portion of its length with a series of resilient projections, said thread member having an outer diameter defined by said projections;

a loop member defining an opening having a linear dimension substantially larger than said outer diameter; and

joining means for connecting one end of said thread member to said loop member, at least one of said joining means and said loop member defining at least in part an aperture having a linear dimension smaller than said outer diameter, said aperture communicating with said opening defined by said loop;

locking means, provided on at least one of said joining means and said loop member, for preventing a removal of said thread member from said aperture upon a passing of said thread member through said loop member and a subsequent pulling of said thread member into said aperture from said loop member; and

a first elongate member slidably inserted in said first biopsy channel, said first elongate member including holding means at a distal end for holding said thread member of said suture device; and

a second elongate member slidably inserted in said second biopsy channel, said second elongate member being provided at a distal end with grasping means for grasping a free end of said thread member upon a moving of at least an end portion of said thread member out from said first biopsy channel upon a distally directed motion of said first elongate member,

said loop member being traversed in said second biopsy channel by said second elongate member, said thread member extending from said loop member through said connecting channel to said first biopsy channel.

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